# MA 3042
## LECTURE SYLLABUS and COURSE OUTLINE
### Fall Quarter, 2002

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**Text:** *Linear Algebra with Applications,* 6th Edition, Steven J. Leon, Prentice Hall 2002.

**Course Description:** This is a first course in linear algebra for students who have already learned the fundamental concepts and operations of matrix algebra. The emphasis is on the acquisition of tools that are useful in a variety of areas of mathematics, with special emphasis on techniques useful in optimization. *The course emphasizes abstraction more than an elementary course.* Applications will be presented but, due to time constraints, will only be used to motivate the study of the core material.

**Exams:** <u>Three</u> exams will be given. The *first* and the *second* exams, in weeks **four** and **eight**, respectively, will be worth **100** points each (40% of total grade). The **final** exam, worth **200** points (45% of the grade), will be comprehensive. Quizzes will have a (scaled) cumulative value of 100 points. With the exception of weeks <u>one, nine</u>, week <u>eleven</u> and exam weeks, quizzes will be given weekly (or nearly so) on Tuesdays and will cover the previous week's topics.

| WEEK | SECTION | TOPICS |
|---|---|---|
| 1 | 3.1-3.3 | Vector Spaces and Subspaces, Linear Independence |
| 2 | 3.4, 3.5, 3.6 | Basis and Dimension, Change of Basis, Row/Column Spaces, **Quiz 1** |
| 3 | October 14 | Columbus Day |
|  | 3.6, 4.1-4.3 | Row/Column Spaces, Linear Transformations, Similarity, **Quiz 2** |
| 4 | 5.1, 5.2 | Scalar Product in $\mathbf{R}^N$, Orthogonal Subspaces |
|  | October 22 | **Midterm 1** |
| 5 | 5.3-5.5 | Least Squares, Inner Product Spaces, Orthonormal Sets, **Quiz 3** |
| 6 | 5.6 | Gram-Schmidt Orthogonalization, QR Factorization, **Quiz 4** |
|  | 6.1, 6.3 | Eigenvalues/Eigenvectors, Diagonalization |
| 7 | November 11 | Veterans Day |
|  | 6.4, 6.5 | Hermitian Matrices, Singular Value Decomposition **Quiz 5** |
| 8 | 6.5, 6.6 | SVD, Quadratic Forms |
|  | 6.7 | Positive Definite Matrices, Cholesky Factorization |
|  | November 21 | **Midterm 2** |
| 9 | 7.1 | Floating Point Numbers |
|  | November 28 | Thanksgiving |
| 10 | 7.4 | Pivoting Strategies, Matrix Norms, Condition Numbers |
|  | 7.5 | Orthogonal Transformations, **Quiz 6** |
| 11 | 7.5 | Orthogonal Transformations |
| 12 | **Final** | Comprehensive, Wednesday December 18, 1-3 pm, in G118. |

| HOURS | TOPIC | SECTION | HW |
|---|---|---|---|
| 1 - 1 | Vector Spaces | 3.1 | 3, 4, 6, 7, 11, 12 |
| 1 - 2 | Subspaces | 3.2 | 1, 3, 4, 5, 6, 9, 11, 13, 14 |
| 2 - 4 | Linear Independence | 3.3 | 1-4, 6, 7, 11, 14 |
| 1 - 5 | Basis and Dimension | 3.4 | 3-5, 7, 8, 11, 12 |
| 2 - 7 | Change of Basis | 3.5 | 2c, 4-9 |
| 1 - 8 | Row and Column Spaces | 3.6 | 1b, 2c, 3, 6, 7, 9-11, 15 |
| 2 - 10 | Linear Transformations | 4.1 | 1, 2, 3, 6, 14, 15, 16 |
| 1 - 11 | Matrix Representation of Linear Transformations | 4.2 | 2a, 4, 5b, 6, 8a,b, 12a, 16a, 18 |
| 1 - 12 | Similarity | 4.3 | 3, 4, 5, 8, 9, 10 |
| 1 - 13 | Scalar Product in $\mathbb{R}^n$ | 5.1 | 1c, 2c, 3-12 |
| 1 - 14 | Orthogonal Subspaces | 5.2 | 3-8, 11 |
| 1 - 15 | The Fundamental Subspaces Associated with a Matrix | 5.2 | |
| 2 - 17 | Least Squares | 5.3 | 1a, 1c, 2, 3a, 4a, 5a, 6, 9a |
| 2 - 19 | Inner Product Spaces | 5.4 | 2, 3, 4, 7b, 8, 10, 19, 20 |
| 1 - 20 | Orthonormal Sets | 5.5 | 2b, 3, 5, 6, 14, 17, 19b |
| 2 - 22 | GramSchmidt Method, QR Factorization | 5.6 | 2b, 3, 5, 7 |
| 2 - 24 | Eigenvalues/Eigenvectors | 6.1 | 1e, 1f, 1g, 3-9, 11, 15, 19 |
| 1 - 25 | Diagonalization | 6.3 | 1a, 1b, 1d, 4a, 4b, 6 |
| 2 - 27 | Hermitian Matrices | 6.4 | 1a, 2b, 3, 5, 10, 11, 12 |
| 2 - 29 | Singular Value Decomposition | 6.5 | 1-5, 9 |
| 2 - 31 | Quadratic Forms | 6.6 | 1, 4, 7, 10 |
| 1 - 32 | Positive Definite Matrices, Cholesky Factorization | 6.7 | 1, 3, 5, 8, 9, 13 |
| 1 - 33 | FloatingPoint Numbers | 7.1 | |
| 1 - 34 | Gaussian Elimination & Pivoting Strategies | 7.2–7.3 | |
| 2 - 36 | Matrix Norms, Condition Numbers | 7.4 | 1,3,5,11,12 |
| 2 - 38 | Orthogonal Transformations | 7.5 | 3a, 4b, 5, 6, 13 |
| 5 - 43 | Exams and Holidays | | |

The instructor reserves the right to modify this schedule, if necessary and after giving due notice of the change.

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